Fraser Lake
Important Bird Area
Conservation Plan

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Foreword

The issue

Many of the lakes in north-central BC are becoming increasingly developed. Past and present land development along the lakeshore has changed the natural character of many lakes. In addition, many of the lakes are becoming increasingly polluted. In some cases dramatic increases in aquatic plants have been observed, resulting in annoying conditions for local residents that in some cases have been linked to fish kills. Fraser Lake is like many other lakes in north-central BC development of lakeshore properties is increasing, as is the abundance of specific types of aquatic plants. How these changes will affect the thousands of waterfowl that use this lake in the fall is unclear.

Summary

This conservation plan provides an overview of the birds that frequent Fraser Lake, outlines the issues that may affect these birds and the habitats that they use, and lays the framework for steps that could be taken to mitigate some of these issues. This plan was written in conjunction with the Nad'leh Bun Watershed Enhancement Society, the Ministry of Air, Land, and Water Protection, Ducks Unlimited, and the Upper Fraser-Nechako Fisheries Council. It is intended to facilitate the future work of the Nad'leh Bun Watershed Enhancement Society.

Availability of report:

This report is available in digital format from the Important Bird Areas web page: www.ibacanada.com.

Executive Summary

What is an Important Bird Area?

An Important Bird Area (IBA) is a site providing essential habitat for one or more species of breeding or non-breeding birds. These sites may contain threatened species, endemic species, species representative of a biome, or highly exceptional concentrations of birds.

The goals of the Canadian IBA program are to: 1) identify a network of sites that conserve the natural diversity of Canadian bird species; and 2) ensure the conservation of sites through partnerships of local stakeholders who develop and implement appropriate on-the-ground conservation plans.

The purpose of this document is to help direct the stewardship initiatives that are being planned by the Nad'leh Bun Watershed Enhancement Society.

The Fraser Lake IBA

Fraser Lake is located near the geographic centre of British Columbia. It is a globally significant wintering site for Trumpeter Swans, a continentally important site for fall migrating waterfowl, and a nationally significant site for fall migrating American Wigeon. It is also one of the key sites for moulting ducks in BC. Like many of the lakes in this area and around the province, lakeshore development has resulted in problems pertaining to water and shoreline quality. Fortunately, Fraser Lake has not encountered the same amount of development as other lakes in the region, but local residents have noticed changes to the lakeshore in the recent past. Left unchecked, it is unclear how this development may affect the ability of this lake to support the number of waterfowl that presently use it in winter and fall migration.

Current Conservation strategies

Presently there is a volunteer lake-monitoring program that is being conducted by Brian Malchow through the BC Ministry of Water, Air, and Land Protection. This program is being assisted by students from Fraser Lake Elementary Secondary School working to earn experience and career preparation hours required for graduation. In addition, Ducks Unlimited has several projects that involve landowners in the area. Finally, there is presently a volunteer Ecological Reserve Warden for the Ellis Island Ecological Reserve.

Conservation Goals and objectives of this plan

The main goal of this conservation plan is to help the newly formed Nad'leh Bun Watershed Enhancement Society direct and shape their future stewardship initiatives. The main goals of this conservation plan are as follows:

- To promote Fraser Lake as a unique area and encourage responsible lakeshore living;
- To explore the role of NWES as lobby/advisory group; and
- The integration/cooperation of NWES with other communities and non-government groups.

Included in this plan is a discussion of some of the potential prerequisites for the successful implementation of this plan.

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1. Introduction

Fraser Lake is located near the geographic centre of British Columbia. It is in this region that one finds a larger portion of the province's wetlands and a number of areas that represent important breeding, moulting and migratory stopover sites for various species of waterfowl. Of these, Fraser, Tachick, and Nulki lakes have been identified as continentally significant IBAs for migratory waterfowl. Fraser Lake has the added distinction of also being a globally significant site for migratory and wintering Trumpeter Swans. The reason that Fraser Lake site is an IBA for waterfowl is due largely to its geographical location, and to the presence of extensive foraging areas, both on the lake and in adjacent agricultural fields. Trumpeter Swans congregate here because available food is present for extended periods of time, as both the inlet and the outlet of the lake (the Stellako and Nautley rivers) remain ice-free throughout most of the winter.

Development and the resultant problems pertaining to water and shoreline quality have had impacts on lakes throughout the region. Fraser Lake has not encountered the same amount of development as other lakes in the region, but local residents have noticed changes in these domains in the recent past. The primary goal of this conservation plan is to help form a strategic plan for the newly formed Nad'leh Bun Watershed Enhancement Society (NWES). The goals as outlined in this plan fall primarily under the umbrella of outreach and educational initiatives. Included in this discussion are potential prerequisites to the fulfillment of these initiatives and research needs that may not be able to be addressed by NWES.

2. The IBA program

The IBA program is an international initiative coordinated by BirdLife International, a partnership of member-based organizations in over 100 countries seeking to identify and conserve sites important to all bird species worldwide. Through the protection of birds and habitats, they also promote the conservation of the world's biodiversity. There are currently IBA programs in Europe, Africa, the Middle East, Asia, and the Americas.

The Canadian BirdLife co-partners are the Canadian Nature Federation (CNF) and Bird Studies Canada (BSC). The Canadian IBA program is part of the Americas IBA program, which includes the United States, Mexico, and 17 countries in Central and South America.

The goals of the Canadian IBA program are to:

1. identify a network of sites that conserve the natural diversity of Canadian bird species and are critical to the long-term viability of naturally occurring bird populations;
2. determine the type of protection or stewardship required for each site, and ensure the conservation of sites through partnerships of local stakeholders who develop and implement appropriate on-the-ground conservation plans; and
3. establish and support ongoing local involvement in site protection and monitoring.

IBAs are identified by the presence of birds falling under one or more of the following internationally agreed-upon categories:

1. Sites regularly holding significant numbers of an endangered, threatened, or vulnerable species.
2. Sites regularly holding an endemic species, or species with restricted ranges.
3. Sites regularly holding an assemblage of species largely restricted to a biome.
4. Sites where birds concentrate in significant numbers when breeding, in winter, or during migration.

3. IBA Site Information

The Fraser Lake IBA (CABC221G) is situated on the gently rolling hills of the Nechako Plateau near the geographical center of British Columbia (54°04'N, 124° 49' W, Figure 1). This region is dominated by areas of rolling uplands with low ridges and large lakes in depressions, broad lowland areas also with large lakes, and flat lowland areas with extensive areas of small lakes and streams. The IBA encompasses the waters of Fraser Lake, and portions of the Stellako, and Nautley rivers (~ 50 km^2).

The area in and around Fraser Lake is the traditional territory of the Cheslatta, Nadleh Whut'en, and Stellat'en First Nations. It is dominated by stands of spruce and lodgepole pine with scattered patches of trembling aspen and paper birch. Some Douglas-fir stands can be found in the area, but these are uncommon since the area is near the northern limit of its range. Extensive wildfires, coupled with commercial logging, and the clearing of land for agricultural purposes has resulted in a mosaic of habitat types in the area. Younger forested stands are more common at lower elevations due to extensive forest fires and first-pass logging, while older stands (greater that 250 years old) are uncommon and are found at higher elevations or in isolated patches (LRMP 1997). Due to highly effective fire prevention over the last 40-50 years, older stands of timber are at moderate to high susceptibility to bark beetle infestations (LRMP 1997). There are also extensive areas of agricultural development throughout the region.

Fraser Lake receives water from a drainage area of 6030 km^2 that includes Francois, Tchesinkut, Burns and Decker Lakes (Carmichael 1985, Figure 1). The Endako and the Stellako Rivers are the main tributaries of Fraser Lake. The Endako River begins approximately 150 km to the west, flowing through Decker and Burns lakes before emptying into the west end of Fraser Lake. Fraser Lake also receives input from a series of rivers and lakes to the south and west. The Nadina River, which begins in the Hazelton Mountains, flows into Francois Lake, and in turn flows into the west end of Fraser Lake via the Stellako River. Fraser Lake eventually empties into the Nechako River through the Nautley River near the town of Ft. Fraser. The Endako and Stellako Rivers and their tributaries, drain approximately 92% of the total basin. The remaining portion of the drainage area includes streams and creeks, most of which are located on the north shore of the lake, with Ormond Creek being the largest contributor (Figure 2).

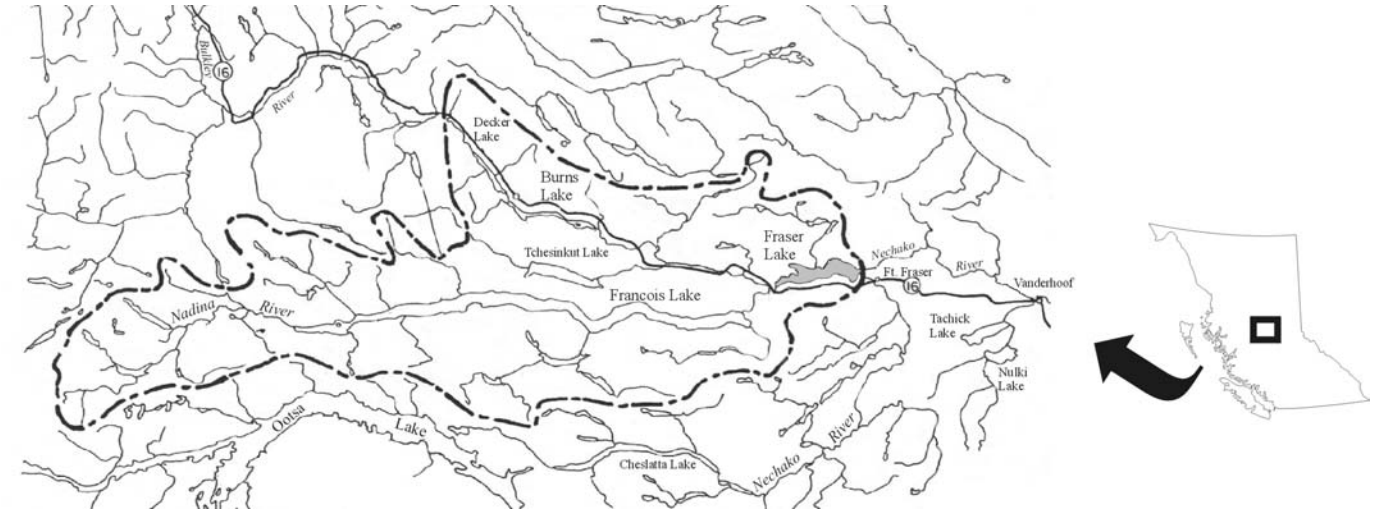

Figure 1. Drainage basin of Fraser Lake (from Carmichael 1985)

The area immediately surrounding Fraser Lake is a relatively sparsely populated area. Approximately 500 people live on the Stellat'en and Nad'leh Whut'en First Nations Reserves. Outside of these reserves, the area surrounding the lake is a mix of residential development that is either permanent or seasonal. Residential areas are concentrated in the town of Ft. Fraser (population 500) and the Village of Fraser Lake (population 1300). Seasonal dwellings are concentrated in lakefront areas on the north side of the lake. Housing in the Village of Fraser Lake is primarily restricted to the benches above the lake due

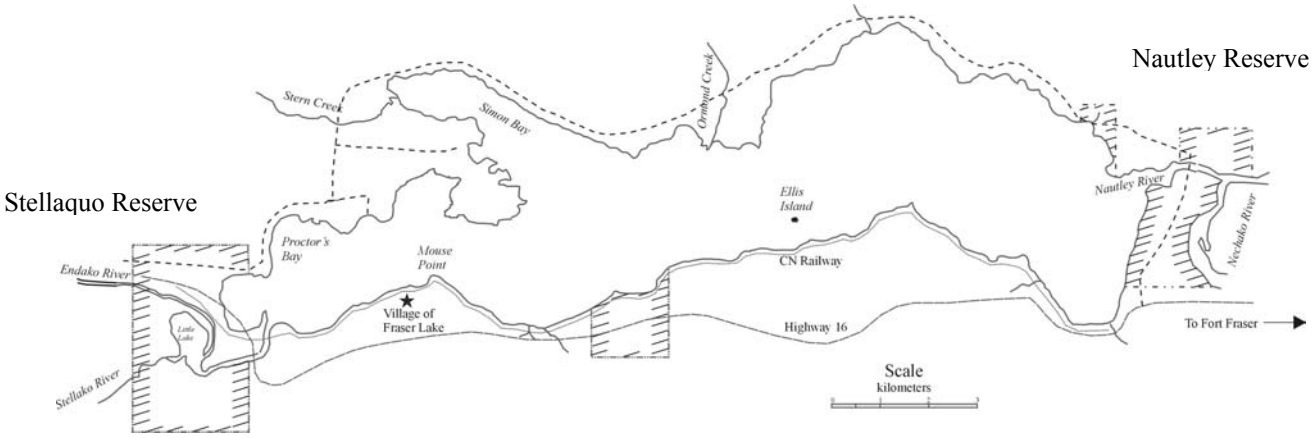

Figure 2. Fraser Lake and associated areas

the presence of the CN railway line that runs along the southern shoreline of the lake. Extensive rural acreages and larger farms and ranches are located along the north shore of Fraser Lake, and in the areas south and east of the lake (Figure 2).

Fraser Lake itself is a large narrow lake with extensive shallow, or littoral areas (Figure 3, Table 1). These shallow areas provide excellent habitat for various species of aquatic plants. It is these areas, particularly at the west end of the lake, where waterfowl concentrate. There are also isolated areas on the north and south shores in the central portion of the lake where waterfowl congregate (M. Clark, pers. comm.).

Table 1. Physical data for Fraser Lake

Parameter	Measurement
Maximum length	19 km
Maximum width	4 km
Surface area	54.6 km^2
Volume	7.253 x 10^7 m^3
Average depth	13.3 m
Maximum depth	30.5 m

(from Carmichael 1985)

4. IBA species information

Fraser Lake is a globally significant wintering site for Trumpeter Swans. Over a five-year period (1993-97) an average of 1026 swans were counted in the early winter (November) with the peak of 1232 swans in 1995 (Table 2; Unpublished data, Village of Fraser Lake). In addition, 1277 swans were counted in November 1990 during aerial surveys conducted by Ducks Unlimited (Unpublished data, Ducks Unlimited). These numbers of swans are typically seen in early winter; numbers decrease as the winter progresses and the lake begins to freeze over. At this time, the swans congregate in ice-free regions, particularly along sections of the Stellako and Nautley rivers (Figure 3). Upwards of 200-300 swans

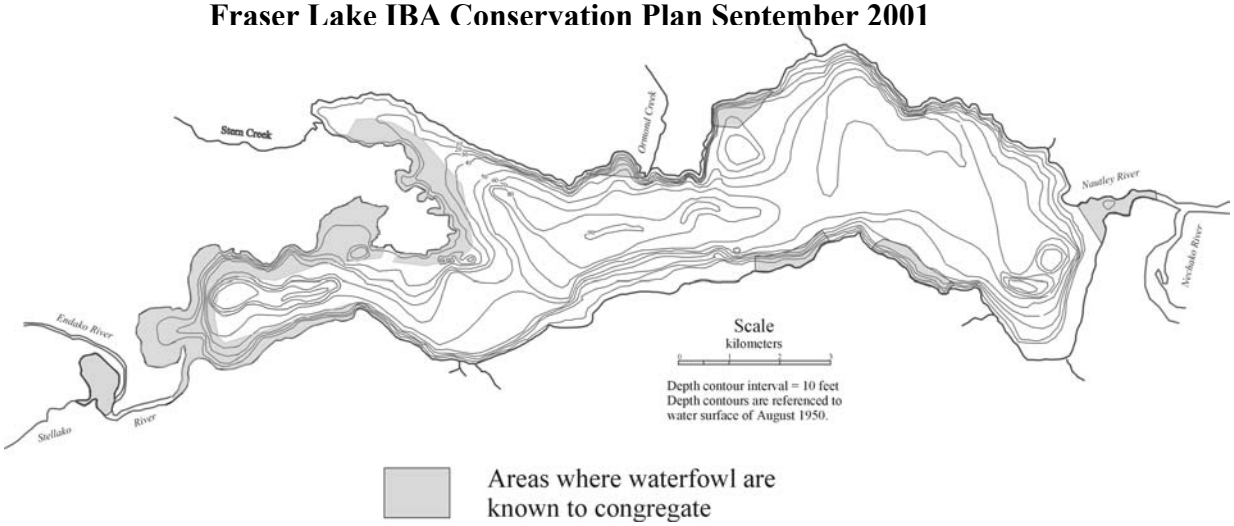

Figure 3. Bathymetric outline of Fraser Lake with areas of waterfowl concentration. (areas of waterfowl congregation courtesy of M. Clark, pers. comm.)

remain throughout the winter, especially in the vicinity of the Nautley River where an active feeding program is ongoing (L. LaRoque, pers. comm.).

Fraser Lake is also a continentally important site for fall-migrating waterfowl and a nationally significant site for fall-migrating American Wigeon. Aerial surveys conducted by Ducks Unlimited in the late 1980s and early 1990s recorded peak counts of between 12,445 and 28,544 ducks, geese, and swans on the lake in late fall. American Wigeon was by far the most common waterfowl species recorded on these surveys, with peak numbers reaching 10,824 birds. Furthermore, as many as 9,582 Canada Geese were recorded during these surveys and upwards of 3400 unidentified diving ducks (e.g., mergansers, grebes, goldeneyes, Buffleheads) have been recorded during the same surveys (Unpublished data, Ducks Unlimited). Other waterfowl species that use the lake include Mallard, Gadwall, teal, scaup, and American Coot.

Fraser Lake, together with two other lakes to the southeast (Tachick and Nulki) is also regarded as extremely important lake for moulting waterfowl in BC (A. Breault, pers. comm.). Ducks moult (shed and replace their flight feathers) at certain times of the year. During these times they are unable to fly and are vulnerable to disturbance. Moulting areas or lakes are often used year after year, and are an essential part of the life history of this group of birds.

Table 2: IBA species and the time at which they are present at the Fraser Lake IBA.

Species or groups meeting IBA criteria	Season[1]	Number[2]
Trumpeter Swan	W	1026 ± 257 (5 year average 1993-7)
American Wigeon	FM	10,824 (peak, 1990)
Waterfowl	FM	18,048 (1987/89/90 high count average)

[1] W=winter, FM=fall migration
[2] Bird numbers from BSC (2001).

4.1. IBA Species Accounts

4.1.1 Trumpeter Swans

Trumpeter Swans breed in three distinct areas of North America. The Pacific coast population breeds in interior and coastal areas of south-central Alaska. This population winters along the coast from Alaska, south to Oregon. The Rocky Mountain population consists of two sub-populations. The interior sub-population breeds in Alberta, northeastern BC, southern Yukon, southwestern Northwest Territories and southwest Saskatchewan. This sub-population winters in the Tri-State Area (Wyoming, Idaho,

Montana) as well as on lakes and rivers that remain ice free in the BC interior (e.g., Fraser Lake, the Middle, Stuart, Tachie, Crooked, and South Thompson rivers). The Tri-State sub-population remains in the Tri-State area year-round (Campbell et al. 1990a). It is assumed that the swans found on Fraser Lake are part of the Rocky Mountain population; however, some of the swans wintering in the Fraser Lake area may also be part of the Pacific population. During the winters of 1980-1981 and 1981-82, Trumpeter Swans banded near Powell River, BC were later sighted at the head of Toba Inlet, Francois Lake, and the Nautley and Middle rivers in BC, and at Tagish Narrows in the Yukon. This suggests that at least some of the swans wintering on the coast may follow an interior rather than just a coastal migration route (McKelvey and Burton 1985).

The autumn movement of swans from breeding locations on the Pacific coast occurs in mid- to late October or November depending upon freeze-up in Alaska. Generally, most birds arrive on wintering grounds in mid- to late November and peak in December (Campbell et al. 1990a). Trumpeter Swans leave coastal areas to return to breeding grounds in late February and early March, with the biggest movement of birds occurring in late March and early April.

In all areas this species breeds on freshwater ponds, lakes, marshes, and occasionally, on rivers (Campbell et al. 1990a, Fraser et al. 1999). Adults feed mostly on aquatic vegetation, including tubers of duck potatoweed and sago pondweed. Stems and leaves of sago pondweed and other aquatic plants such as Canada pondweed (referred to hereafter as *Elodea canadensis*, or *Elodea*) are also consumed (Bellrose 1976). Feeding experiments in Wyoming indicated that adult Trumpeter Swans consume up to 9 kgs of leafy aquatic vegetation per day (Page 1974 as cited in Bellrose 1976). During the first few days of their lives, young swans eat aquatic insects, crustaceans, and some aquatic plants. When they are a few weeks old their diet changes to include more aquatic plants. By the time they are 2-3 months old their diet is similar to that of their parents (Banko 1960). During the fall and winter, Trumpeter Swans subsist on aquatic vegetation such as *Elodea,* duck potato and sago pondweed (NatureServe 2000).

Historically, Trumpeter Swans were more widely distributed than they are at present. Over-harvest, especially due to a commercial market for swan skins (Bellrose 1976), as well as habitat alteration (Campbell et al. 1990a), led to dramatic declines across the species' range, such that this species was, at one time, considered to be on the brink of extinction (Bent 1925). Breeding surveys in the last 30 years suggest that populations have dramatically increased (Fraser et al. 1999). The trend of increasing population numbers on the breeding grounds is also reflected in swans wintering in BC. Mid-winter aerial surveys along the east coast of Vancouver Island and the Lower Fraser River conducted by the Canadian Wildlife Service recorded a 600% increase in Trumpeter Swans between 1970 and 1998 (or 23.2% per year). The wintering population increased from 947 swans in 1970 to 7,111 adult and juvenile swans in 1998 (CWS 2000). Despite these increases, Trumpeter Swans are blue-listed in BC, primarily because of the small breeding population in BC, and because wintering habitat, especially in coastal areas, is threatened by development.

4.1.2 Waterfowl

The various species of waterfowl that use Fraser Lake during fall migration originate from two general areas. The first group of early migrants likely comes from nesting areas within the immediate vicinity of Fraser Lake. In this area birds breed on lakes of various sizes, and on ponds and wetland areas that have been created due to the actions of beavers. Later migrants representing the majority of birds that use Fraser Lake, nest in the northern areas of BC and possibly the Yukon Territory (M. Clark, pers. comm.).

4.1.2.1 American Wigeon

This duck breeds from northern Alaska and the northern Yukon across most of sub-arctic western Canada to James Bay, and south to Oregon, Utah, Wyoming and the Dakotas. They winter from southern Alaska, coastal and south-central BC, to New England and as far south as Texas, Louisiana, Florida, Central America and the West Indies (Bellrose 1976, Campbell et al. 1990a). In coastal BC during the winter, American Wigeon frequent sheltered waters such as estuaries, mudflats, lagoons, fields, sloughs,

marshes, lakes, golf courses and airports. In the interior, this species uses marshes, sloughs, large and small lakes, slow moving rivers, fields and golf courses (Campbell et al. 1990a).

Wigeon migrate in small dense flocks. In the southern interior, northern movement begins in March and usually peak during the first half of April. In the northern interior, movement begins from early April to mid-March, and peaks in late April and early May (Campbell et al. 1990a). Male Wigeon desert the females shortly after incubation begins (mid-June) and move to large lakes and marshes to moult (Bellrose 1976). Autumn movement usually begins from mid to late August. In the interior this movement peaks in mid-October and declines rapidly in the north, and gradually through November in the south.

American Wigeon breed throughout most of BC, east of the Coast Range, between 660 and 1090 m in the vicinity of freshwater sloughs ponds, lakes, marshes, and rivers. Their centre of abundance is in the Chilcotin-Cariboo and Peace River Parklands. They also breed regularly, but in smaller numbers, in the south-central interior, the Kootenays, the Nechako Lowlands and the Peace River boreal regions. Relatively few nests have been found because they tend to be located in brushy upland habitats, sometimes far from water. Unlike most waterfowl that feed primarily on the seeds of aquatic and marsh plants, Wigeon feed on leaves, stems, buds, and to a lesser extent seeds of pondweeds, Wigeon grass, grasses, and sedges in shallow water (Bellrose 1976). They may also consume some snails, beetles, and crickets (Terres 1980 from NatureServe 2000). Wigeon are also known to steal aquatic plants from the beaks of feeding diving ducks such as Redheads and Coots (Bellrose 1976). Like Canada Geese, Wigeon also have been known to feed intensively on in agricultural areas, where they at times have caused damage to cultivated crops. (Bellrose 1976).

4.1.2.2 Canada Geese

Canada Geese breed from the Arctic coast of Alaska to northern Canada, east to Labrador and Newfoundland, south to central California, northern Utah, Kansas, Arkansas, Tennessee, Kentucky and central Ohio. They winter locally from southern Canada to northern Mexico and the Gulf Coast of the US (Campbell et al. 1990a). In BC they are widely distributed, and can be found anywhere permanent water and grazing opportunities are available

Most Canada Goose populations are stable or increasing. In some southern regions of BC, Canada Geese are widely viewed as pest species. This reputation has grown largely because of human-induced changes in the breeding patterns of this species. Currently, introduced populations of resident (i.e., non-migratory) Canada Geese have become established and are increasing throughout southern BC (Campbell et al. 1990a). These populations have caused problems ranging from high density of goose feces in public parks, beaches and golf courses, to direct damage of agricultural crops (Conover and Chasko 1985, Breault and McKelvey 1991). Resident populations have also increased in eastern North America. In the northeastern US, resident populations of Canada Geese have doubled from 1989 to 1996 to nearly 800,000 birds (USFWS 1996 from NatureServe 2000). In contrast, the migratory populations of Atlantic Canada Geese that breed in northern Quebec and winter in the Atlantic Flyway have declined from 118,000 in 1988 to 29,000 in 1995 (USFWS 1996 from NatureServe 2000). In BC, natural (i.e., migratory) populations still exist in BC and occur mostly north of 52° latitude.

There are three Canada Goose migration routes in BC: offshore, coastal, and interior. The offshore route is least well known. Commercial fishing boats have reported seeing migrating geese 48 km from shore (Campbell et al. 1990a). The coastal movement is most noticeable on the west coast of Vancouver Island, particularly near Tofino. The interior migration route extends from late August through November and peaks in mid-September. First spring migrants arrive in southern areas in late February and early March, and in northern areas in late March. This movement peaks in the Chilcotin-Cariboo in mid-April and in the Nechako Lowlands a week later (Campbell et al. 1990a). There may also be an additional large spring movement through the interior that goes largely unnoticed because it occurs at altitudes of up to 4570 m (Campbell et al. 1990a).

Canada Geese breed throughout the province from sea level to 1250 m. They use a variety of habitats for breeding, including inland and coastal marshes, islands in lakes, ponds, sloughs, rivers,

tundra, muskeg, and man-made habitats such as reservoirs, ditches, dykes, sewage lagoons, and agricultural fields (Campbell et al. 1990a). These geese feed on marsh grasses, sprouts of winter wheat (spring), grain (fall), clover, cattails, bulrushes, algae, pondweed, and other plants. In addition, they also feed upon molluscs and small crustaceans (Terres 1980 from NatureServe 2000). Like Wigeon, they feed in shallows, marshes, and in fields.

Various authorities recognize 8-12 or more subspecies of Canada Goose. Generally, tundra populations comprise small birds, whereas southern birds are much larger, with medium-sized birds in intermediate localities (NatureServe 2000). Reintroductions from mixed stocks have greatly muddied the traits of many southern populations. There are seven subspecies of Canada Geese that occur in BC, four of which have been recorded in the Fraser Lake area (Campbell et al. 1990; Table 3).

Table 3. Subspecies of Canada Goose that occur in BC

Common name	Latin name
Cackling Canada Goose*	*Brant canadensis minima*
Dusky Canada Goose*	*Brant canadensis occidentalis*
Lesser Canada Goose*	*Brant canadensis leucoparia*
Pacific Canada Goose	*Brant canadensis fulva*
Short Grass Prairie Canada Goose	*Brant canadensis parvipes*
Western Prairie Canada Goose*	*Brant canadensis moffitti*

* sub-species recorded on Fraser Lake

5. Other elements of high conservation value

5.1 Diving ducks

Upwards of 3400 unidentified diving ducks (e.g., mergansers, grebes, goldeneyes, Buffleheads) have been recorded on Fraser Lake during the Ducks Unlimited surveys in the late 1980s. Unlike dabbling ducks (e.g., American Wigeon, Mallard), geese and swans, diving ducks swim underwater in pursuit of fish, insect larvae, molluscs and crustaceans

5.2 Ellis Island

Ellis Island (District Lot 6345, Range 5, Coast District) is a small (~ 1 ha) rocky island off the central shore of Fraser Lake (Figure 2). The island is the tip of an substantial mass of basalt and shows signs of heavy glaciation (Hubbard 1980). There are four different habitat types: aspen-cottonwood scrub forest, rose-raspberry thickets, fescue-bluegrass grasslands, and stonecrop outcrops (Hubbard 1980). The patches of scrub forest provide patches of nesting cover for nesting waterfowl (e.g., Mallards and Pintail), while American Crows, Tree Swallows, and various songbirds nest in trees and shrubs (Campbell and Garrioch 1978). Of particular interest is the nesting colony of Herring and Ring-billed Gulls on this island (Campbell and Garrioch 1978, Campbell et al. 1990b). Herring Gulls are known to nest in approximately 40 locations scattered throughout the interior of the province, while there are only two active breeding colonies of Ring-billed Gulls in BC: Ellis Island on Fraser Lake and Whiskey Island, Okanagan Lake (Campbell et al. 1990b). In 1985 there were 14 pairs of Herring Gulls and 24 pairs of Ring-billed Gulls nesting on Ellis Island (Campbell 1985). Because the colonies of these two species are generally small, they are particularly vulnerable and sensitive to environmental contamination and disturbance (Campbell and Garrioch 1978). Ellis Island was designated as an ecological reserve in March of 1991 for the protection of these nesting gull colonies.

5.3 Adjacent agricultural fields

Of particular importance to the migratory waterfowl in the Fraser Lake area is continued access to agricultural fields in the area. Canada Geese and several species of ducks feed in the fields in the

surrounding areas. Presently, there is minimal conflict between the use of fields by birds and the agricultural sector in the Fraser Lake area. This is an issue of increasing concern in the southern part of the province because waterfowl are often feeding in agricultural fields in the spring. At this time of the year, grazing pressure by waterfowl can result in significant damage to newly planted crops. The lack of conflict in the Fraser Lake area is due largely to the fact that waterfowl are utilizing agricultural fields in the fall when damage to crops is much reduced (M. Clark, pers. comm.).

5.4 Fish

Fraser Lake provides habitat for a wide range of fish species. Both Sockeye and Chinook Salmon pass through Fraser Lake en route to spawning areas in associated tributaries. Of note are the Sockeye runs of the Nadina, Stellako and Nithi rivers. Other sportfish known to occur in Fraser Lake include Kokanee, Dolly Varden, Lake Trout, Mountain Whitefish, Rainbow Trout, White Sturgeon and Burbot. Non-sport fish including Northern Pike-minnow, Largescale Sucker, and Peamouth Chub are also known to occur in the lake.

6. Land ownership and use

6.1 Past

Human habitation in the Fraser Lake area dates back at least several hundred years. The Natliwoten and Stellawoten Tribes of the Carrier/Sekanni Nation lived a semi-nomadic life, during which time they used the waterways, trails and forests as their source of sustenance, transportation, and communication. In particular, they relied heavily on sockeye salmon runs for subsistence (FLDHS 1986). Contact with European settlers saw a gradual change from a nomadic lifestyle to a more sedentary one. As the fur trade gained prominence in the area, fall villages at the Nautley and Stellako Rivers became more permanent.

European settlement of the Fraser Lake area began in the early 1800s. Simon Fraser's arrival in the area in 1806 saw the establishment of the first fur trading post on the southeast end of Fraser Lake. This trading post gave way to the establishment of Fort Fraser in the early 1890s. European settlers began to come to the area in earnest after the construction of the Grand Trunk Railway in 1914. The establishment of the railway led to significant changes, both from a cultural and an environmental perspective, as settlement in the area accelerated. In addition, the railway provided a means by which to transport goods both to and from the area. The decades following the arrival of the railway saw growth in the agricultural, forestry and mining activities in the area. The construction of the CN railway also led to a significant change in the nature of the shoreline along the south side of the lake. Over the approximately 20 km where the railway skirts the lake there has been considerable degradation to the natural shoreline. In numerous places, the shoreline has been straightened, and the original shoreline habitat has been largely eliminated.

Historical records suggest that prior to the 1913 obstruction of the Fraser River at Hell's Gate, the Stellako River supported a significant proportion of the total sockeye run on the Fraser River system. After the elimination of the barrier at Hell's Gate in 1917 the sockeye runs on the Stellako remained small until 1946 when the sockeye escapement reached 245,000 fish (IPSFC 1966).

From 1914-1948, logs were floated or driven down the Stellako River to mills on Fraser Lake. Drives began in late spring and continued until late August. To facilitate log driving, a second channel was constructed near the lower end of the river that diverted flow from the original channel and destroyed 180-270 m of spawning channel (IPSFC 1966). A test drive was conducted in 1965 to assess the possibility of renewing this practice, but due to observed degradation of spawning habitat, further log drives were prohibited (IPSFC 1966).

During the 1950s approximately 50% of the Nechako River flow was permanently diverted into a separate watershed in order to generate hydroelectric power for an aluminum smelter on the Pacific Coast. This alteration of flow had numerous consequences. Initial drops in the level of the Nechako resulted in the formation of a series of rapids close to the confluence of the Nautley and Nechako Rivers. The

formation of these rapids led to the erosion of the banks of the Nautley towards Fraser Lake. Had this problem not been addressed, the bridge across the highway would have been destroyed and the level of Fraser Lake would have been permanently lowered (Anderson 1972). An artificial weir was constructed to ameliorate this problem. This weir has had to undergo numerous repairs since its construction. Upstream dams are also thought to have contributed to serious silt build-up at the junction of the Nautley and Nechako Rivers.

Reductions in the flow of the Nechako have likely increased the abundance of aquatic plants, such as *Elodea canadensis*, in slow moving reaches of the river (e.g., between Vanderhoof and the Stuart River inflow, and the upper Nechako; French and Chambers 1997). In addition, flow reductions may have resulted in a change in the distribution of waterfowl in the region. Use of Fraser Lake may be increasing due to successional changes to riparian habitat down stream. Without the seasonal flooding, and hence scouring of riparian areas, some of the traditional areas where waterfowl were abundant have become less used. At one time the Nechako Bird Sanctuary near Vanderhoof was a focal point for congregating waterfowl. However, with changes to the water-flow of the Nechako the area has become less attractive to waterfowl due to the increased abundance of woody shrub and tree growth (M. Clark, pers. comm.).

6.2 Present

There are presently two First Nation Reserves in the immediate area of Fraser Lake: Stellat'en and Nad'leh Whut'en. In total, these reserves support approximately 500 people. The land in the area around Fraser Lake is rich in archaeological sites, reflecting past and present use by aboriginal peoples. Currently several areas are of important spiritual and cultural significance to First Nations people in the area including Intatuk, a conical mountain that separates Ormond and Oona Lakes. This area also functions as a place for group gatherings and as a healing centre (LRMP 1997).

Outside of the Stellat'en and Nad'leh Whut'en reserves, the area surrounding the lake is a mix of residential development (e.g., single family dwellings or apartments) that are either permanent and seasonal, rural acreages, and larger farms and ranches. Residential areas are concentrated in the town of Ft. Fraser (population 500) and the Village of Fraser Lake (population 1300). Seasonal dwellings are concentrated in lakefront areas on the north side of the lake. Housing in the Village of Fraser Lake is primarily restricted to the benches above the lake due to the presence of the CN railway line that runs along the shoreline of the lake. Rural acreages and larger farms and ranches are located along the north shore of Fraser Lake, and in the areas south and east of the lake. Private and leased farmland is the largest land use type in the area. The climate and soils of the region are well suited to a livestock and forage-based agriculture, and consequently a large percentage of the area is devoted to the production of forage, the provision of pasture and the cultivation of feed grains (RDBN 1988).

There are significant mineral resources in the area. Presently the Endako Mine currently produces molybdenum. Commercial timber harvesting is ongoing throughout the Fraser Lake drainage basin. There are also a number of woodlots in the area, with a high potential for future woodlots due to proximity to private lands and mills in the valley (LRMP 1997).

There are two regional and one provincial parks in the Fraser Lake area. Mouse Mountain Park has trails through forested habitat that leads to the top of the mountain and provides views of Fraser Lake. White Swan Park is a day use park with beach area, playground and washroom facilities. Beaumont Provincial Park at the east end of the lake is a provincial government campsite that provides both day and overnight uses that are primarily focused on water-related activities (e.g., fishing, swimming, and boating).

7. Conservation concerns

7.1 Water quality

To elucidate changes in water quality the Ministry of Water, Land, and Air Protection (MWLAP), Prince George, obtained sediment core samples from the central and western basins of Fraser Lake. Lake sediment cores can help determine how the nutrient loadings to lakes change over time because changes

in water quality over time are accompanied by changes in local plant and animal life. Should an increase in nutrients occur, those species (diatoms in these analyses) that favor more nutrient rich environments will become more abundant in the lake at that time and will ultimately appear in the lake sediments. The analysis of the core samples taken from Fraser Lake indicate there have been no significant changes in diatom assemblages from either sample point within the lake suggesting that the water quality (in terms of nutrients) of Fraser Lake has changed little over the last 200 years (Cummings 2001). Fraser Lake has always been as mesotrophic lake (a lake that is neither nutrient rich or nutrient poor). There were however, significant increases in sedimentation, particularly at the west end of the lake post 1950 (Cummings 2001) that may have come as a result of watershed activities (e.g., forestry, land clearing for agriculture).

7.1.1 Local impacts on water quality

Although the core samples obtained from Fraser Lake suggest that the water quality of Fraser Lake has not changed significantly (Cumming 2001), the water of Fraser Lake is nonetheless being affected from both point and non-point sources (Carmichael 1985). Point sources, or effluent from known sources such as the sewage treatment plant servicing the Village of Fraser Lake, is likely causing the proliferation of *Elodea* in the vicinity of the municipal outfall (Carmichael 1985). Non-point sources such as stormwater runoff, septic systems and gray water, agriculture, land clearing, and boating, can all contribute to local water quality problems. Stormwater runoff can carry fertilizers, herbicides and pesticides from lawns and gardens, as well as sediment from modified shorelines and riparian areas into the lake. Onsite septic systems can also contribute an additional source of nutrients that can lead to continued weed/algae growth in localized areas (Carmichael 1985), as well as introducing various kinds commonly used chemicals (e.g., cleaning solutions) into the lake. The extent of this input is dependent upon the individual user and the functioning of local septic systems. Poorly managed agricultural practices can also introduce nutrients and pathogens from manure as well as sediment into lake waters.

Oil and fuel leaks from boats are the main concern from boating on Fraser Lake. Boats are also known to be one of main ways in which nuisance plants (e.g., Eurasian Water-milfoil) spread from lake to lake. There are also concerns regarding phenol contamination of the lake from the railway ties that line the south shore of the lake.

7.1.2 External influences on water quality

While the Village of Fraser Lake and individual residences around the lake undoubtedly discharge nutrients in to the lake, which can contribute to the proliferation of weeds and negatively impact water quality, most of the input into the lake likely comes from outside the Fraser Lake area (Carmichael 1985). The Endako and Stellako Rivers provide much of the nutrients that enter into Fraser Lake since they drain approximately 92% of the total basin (Carmichael 1985). Of the two rivers, the Endako is believed to contribute most of the nutrients because it is a more productive river, and it passes through, or is influenced by, a higher population than the Stellako River (Carmichael 1985). It is also likely that the input of nutrients from these systems has increased in recent years due to increased settlement and development in the area. Therefore the issue of water quality in Fraser Lake is a regional as well as a local concern. In other words, upstream communities as well as the residents of Fraser Lake have an impact on the water quality of Fraser Lake.

7.2 Land use

7.2.1 Land clearing: nutrient inputs and siltation

Land clearing in and around Fraser Lake has taken place over several decades. Most of the historical clearing has involved the conversion of forested lands for the purposes of agriculture (pastures and forage production). This type of conversion continues to this day in the Fraser Lake area. Commercial forestry has also altered significant portions of the watershed. Extensive forest harvesting (generally clear-cutting followed by planting) has occurred throughout the area. Recently, significant changes have

also occurred along the shore of Fraser Lake. Increased development along the foreshore areas has seen a conversion of forested lakeshore to a more pastoral, lawn-like setting.

Timber harvesting and the conversion of the land base from forested to some other land use purpose (e.g., agricultural and lakeshore residential uses) are important for two reasons. First, land clearing can increase the amount of nutrients, especially, phosphorus, that enter to riverine and lakeshore areas (Chichester et al. 1979, AGRA 1999). Second, land use practices such as land clearing, cattle ranching, forestry, and road building can also increase siltation levels of creeks. Combined, these two consequences of development can lead to changes in the character of a freshwater system. As previously discussed, increases in nutrients from external sources can stimulate nuisance growth of algae and aquatic macrophytes such as *Elodea*. Furthermore, increases in sedimentation can accelerate the natural infilling process of lakes, thereby increasing the potential for the expansion of the littoral zone (areas of shallow water), and can lead to weed expansion (AGRA 1999).

7.2.2 Foreshore development—loss of native vegetation

Many of the lakes in the Prince George Region have seen increased development in recent times. The development of lakeshore properties often entails the clearing of existing indigenous vegetation from lakeshore areas and replacing it with non-native grasses. Likewise, cabins are often constructed close enough to the shoreline of lakes that a significant portion of the lakeshore is altered during construction. In both cases this conversion, or elimination of foreshore habitat, has three readily identifiable consequences. First, there is an increased influx of nutrients that result from both establishment and care of new lawns. Second, the elimination of foreshore vegetation can increase rates of shoreline erosion. Third, the lack of natural shoreline habitat can reduce or eliminate potential nesting habitat for many species of birds including some waterfowl species. Clearing of shoreline habitat also results in decreases of visual screening for nesting, feeding and resting birds, which in turn can lead to increased disturbance of these birds.

One of the most significant losses to shoreline habitat in the Fraser Lake area occurred when the CN railway was built. The railway stretches along 20 km of shoreline on the south side of Fraser Lake. Along this area there has been considerable degradation of the natural shoreline habitat. In numerous places the shoreline has been straightened and the original habitat removed.

7.3 Weeds: Fraser Lake and increases in the abundance of *Elodea canadensis*

Beginning in the early 1980's concerns were being raised regarding the proliferation of weeds, primarily *Elodea canadensis* in certain areas of Fraser Lake. This naturally occurring aquatic plant was abundant in the west end of the lake and has been spreading continually since that time. In places in Fraser Lake, heavy growth of *Elodea* has reached the surface up to 200 m from shore (Carmichael 1985). The combined influences of the natural history of *Elodea* and the physical characteristics of Fraser Lake pre-dispose this lake to the colonization and increased abundance of this aquatic plant.

7.3.1 Natural History of Elodea

Elodea is a naturally occurring plant in BC. It lives entirely underwater with the exception of its small white flowers that bloom at the surface (Figure 4). It produces winter buds from the stem tips, which overwinter on the lake bottom (Wetzel 1975). *Elodea* can also overwinter as an evergreen plant and can continue to grow under the ice, albeit at decreased levels of productivity (Reid et al. 1973). This can give it a competitive advantage over other aquatic plants in successive seasons (Wetzel 1975). In the fall, leafy stalks detach from the parent plant, float away, root, and start new plants. This is *Elodea*'s most important method of spreading, with seed production playing a relatively minor role (WSDE 2001).

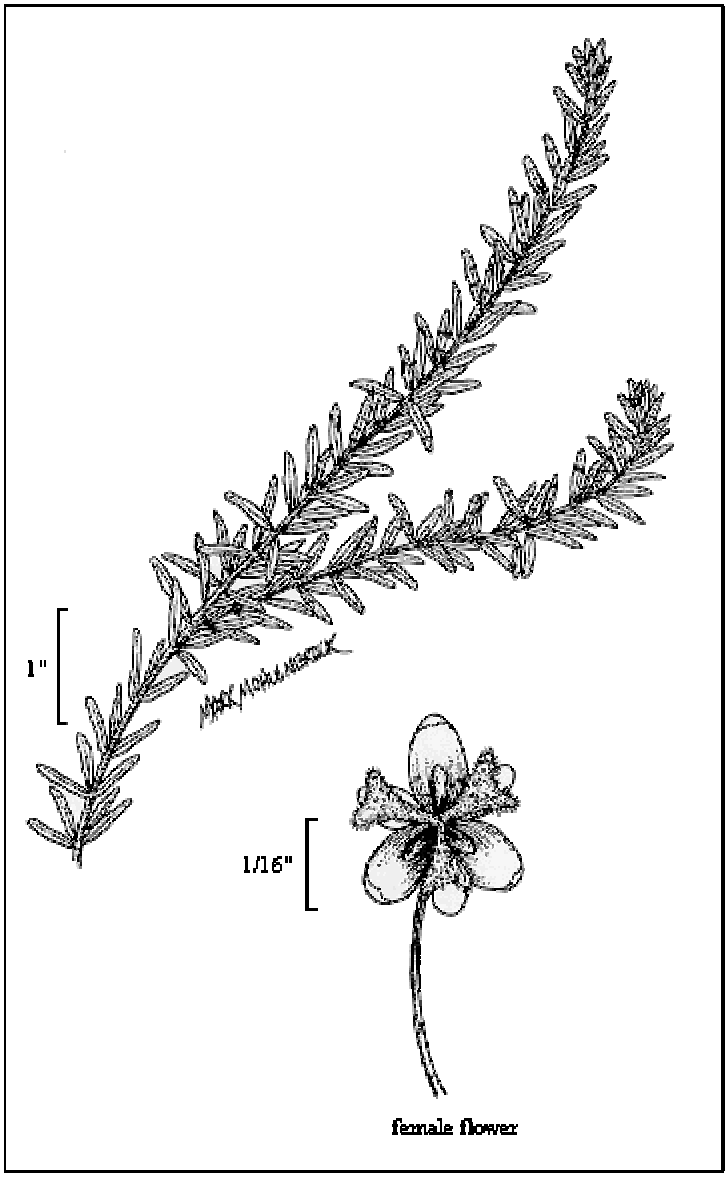

Figure 4. *Elodea canadensis* (from Northern Prairie Wildlife Research Center 1999)

Elodea is an important part of lake ecosystems. It provides habitat for many aquatic invertebrates and cover for young fish and amphibians, as well as food for waterfowl, beavers and muskrats (Bellrose 1976, WSDE 2001).

7.3.2 Natural and human induced changes to Elodea habitat

There are a number of factors that make Fraser Lake a place where *Elodea* can proliferate. Like many large lakes, Fraser Lake tends to an extremely windy lake. Strong winds experienced on the lake generally blow from the areas of greatest concentration of *Elodea* to areas of lower concentration (e.g., from the west end of the lake to the east end of the lake). Given *Elodea*'s propensity to propagate vegetatively, and the fact that the winds of Fraser Lake blow from areas of *Elodea* concentration, areas of Fraser Lake are continually subject to repeated colonization events.

In addition to the strong winds that occur on Fraser Lake, a large portion of the lake (16%) is less than 4 m deep, much of which contains silty soils. These areas are potential places where common aquatic plants such as *Elodea* can take root (Carmichael 1985). Furthermore, these areas may have increased in recent times. Lake core samples taken by MWLAP suggest that there have been significant increases in sediment loading in Fraser Lake (Cummings 2001). It is unclear what the causal factors of these increases in sedimentation are, but decreased water levels in Fraser Lake in the 1970s due to changes in precipitation (Carmichael 1985) and both natural increases and landuse practices such as land clearing and forestry (I. Sharpe, pers. comm.) are possible reasons.

Large aquatic plants like *Elodea,* also tend to increase in abundance when nutrients become available (Harper 1992, Best et al. 1996, Bronmark and Hanson 1998). In the case of Fraser Lake, there are several sources of potential nutrients. The Stellako and Endako river systems provide a continuous flow of nutrients into Fraser Lake. In addition, there are localized sources of nutrients such as the Village of Fraser Lake sewage treatment plant, small surface runoff and ground water flows, agricultural drainage, flows from lakeshore septic tanks, and decaying salmon carcasses (after spawning occurs), all of which can contribute to localized blooms of *Elodea* (Carmichael 1985).

In summary, the increase in the abundance of *Elodea* is difficult to determine. The spread of this plant appears to be a response to several conditions. First, *Elodea* is a dynamic plant that is capable of fast

and prolific growth, even in northern climates. Second, Fraser Lake is an ideal place for *Elodea* to thrive: there are extensive areas of suitable habitat and the amount of this habitat may have increased in recent times. Third, strong winds help spread *Elodea* over a large area. Fourth, Fraser Lake receives continual nutrient inputs that are both regional and local in nature. It is difficult; however, to link the increases *Elodea* to any one of these factors.

7.3.3 Potential impacts of Elodea (present and future)

Elodea is a fast growing aquatic plant that can form dense mats that, can in time, shade other aquatic plants potentially resulting in a less diverse aquatic community (in terms of fish, plants and insects; Wetzel 1975). The formation of dense mats of *Elodea* in the vicinity of water intakes can also lead to decreases in water quality. On Fraser Lake, water quality in isolated areas has been impaired during late winter because of anaerobic production of gases such as hydrogen sulfide and ammonia. These conditions are likely due to the decomposition of dense beds of *Elodea* in proximity to water intakes (Carmichael 1985). The tendency of *Elodea* to form dense mats can be problematic as these mats can hinder access to certain areas for recreational activities such as boating and swimming. Dense mats of *Elodea* can also hinder salmon migration.

7.4 Disturbance of birds nesting at Ellis Island

There is some evidence (e.g., fire pits and refuse) that people are landing on Ellis Island for recreational purposes, although this disturbance appears to be infrequent. However, if this disturbance occurs during critical times of the nesting season, gulls may cease to use this island for nesting purposes.

8. Conservation management achieved at the IBA site

Presently there is a volunteer lake-monitoring program in place. This program, which began in the late 1990s, regularly monitors lake water quality. The data collected by this team of volunteers is relayed to MLAWP in Prince George.

There are few protected areas in the areas surrounding Fraser Lake. Ellis Island is an ecological reserve on Fraser Lake. A volunteer warden visits the reserve infrequently due to problems with access. In addition, recreationalists sometimes visit the reserve such that disturbance to nesting birds is a potential concern. Two regional parks (Mouse Mountain Regional Park and White Swan Park) provide day use areas for hiking, and swimming, respectively. Beaumont Provincial Park at the east end of the lake is a provincial government campsite that provides both day and overnight uses that are primarily focused on water-related activities (e.g., fishing, swimming, and boating).

9. IBA stakeholder group activity

A new, action-orientated conservation organization was recently initiated in the Fraser Lake area. The Nad'leh Bun Watershed Enhancement Society (NWES) was created in late 2000 and presently has the support of numerous local organizations including the Stellat'en and Nad'leh Whut'en First Nations, local and provincial government agencies, municipal mayors and councils, non-profit organizations, forest licensees, consultants, and the public. Presently, NWES has a board of directors that includes representation from a broad spectrum of the community. A visioning workshop was conducted in late April 2001 to help set directions for the work that NWES may embark upon (the mandate of NWES can be found in section 10 Conservation goals and objectives).

Ducks Unlimited has variety projects in the area that manage water levels for the benefit of waterfowl, and have places where nesting boxes, nesting tubes and floating islands are employed to enhance nesting habitat. The Canadian Wildlife Service is examining the natural mercury concentrations in Common Loons and Bald eagles in Fraser, Pinchi, Tezzeron, Great-Beaver and Stuart lakes (S. Lee, pers.com.).

10. Conservation Goals and Objectives

The primary goal of this conservation plan is to help form a strategic plan for the newly formed Nad'leh Bun Watershed Enhancement Society (NWES). NWES views their role as taking a holistic approach to community growth that will include watershed enhancement and preservation projects. A priority-setting workshop that was conducted with the NWES resulted in the identification of several key areas of interest that the society wishes to pursue. The highest priorities for this group are the issues that pertain to a clean and natural environment.

The specific issues that arose during this session focused on:

a) the quality and quantity of shoreline habitat;
b) the diversity of wildlife and wildlife habitat;
c) the security of this habitat; and
d) the quality of water.

Other areas of interest of NWES expressed during this workshop also relate to the natural environment as a means to increase opportunities within the geographic area (e.g., developing Fraser Lake as a destination place, the desire to build a self-determining community). One of the biggest obstacles to fulfilling this vision revolves around the notion that the citizenry of the area may not appreciate the unique setting in which they live and consequently development is slowly altering the character of the lake shoreline. It is widely acknowledged that there are many user groups that need to be included in the discussion of the long-term health of the aquatic habitat in the Fraser Lake area. Each group has both shared and unique issues that could be addressed by the efforts of NWES (Table 4).

Table 4. General user groups that should be included in the discussion of the long term health of the aquatic habitat on Fraser Lake

Group	Potential issue of concern to the health of the aquatic habitat of Fraser Lake
Residential	• shoreline alteration • fertilizer, herbicide and pesticide use if any • improper septic system functioning
Agricultural	• agricultural runoff, herbicide and pesticide use if any • riparian management • assessment of use of land by birds and an assessment of crop damage if any exists
Boaters	• wise use of boats: behaviourally and ecologically

The goals of this conservation plan focus primarily under the umbrella of outreach and educational initiatives with the assumption that a better-informed community will adopt a more proactive approach to lakeshore living. Attention is also given to the potential role that NWES can play in providing input to regulatory agencies where appropriate. A tentative timeline for these initiatives is provided in Table 6. This plan also outlines potential prerequisite needs that may not be able to be addressed by NWES. Included in this discussion are research needs that pertain to the birds that use the lake.

10.1 Promotion of Fraser Lake and responsible lakeshore living

10.1.1 General promotion of area: a short term goal

There is a general sense that the community in and around Fraser Lake does not fully appreciate the unique setting in which they live. Consequently there is development occurring along the lakeshore that is altering the character of the lake. To help stem the further alteration of the character of the lake will require a program to raise the awareness of this area. This could be done in a variety of ways including: 1) the development of a mobile display that could be used at various community functions, 2) the development of signage at selected locations along the lake, 3) the development of interpretive material about lakeshore living to be housed at the present visitors centre, 4) the development of a website, and 5) the continued use of the local media. Consideration should also be given to the development of outreach material regarding the significance of Ellis Island as an ecological reserve both in terms of the birds present on the island, and in terms of appropriate uses of ecological reserves.

In each case, material would promote the society itself, and would introduce the concept of responsible lakeshore living. A static display could be accompanied by the development of an informational brochure that is specific to lakeshore living. It could also have a locally produced video that highlights the area as a significant site for waterfowl and fish, and touches on the wise use of lakeshore property.

It will also be important to take the message of responsible lakeshore/waterfront living to areas upstream of Fraser Lake, since much of the nutrients enter the lake via the Stellako and Endako rivers. This will require NWES to make efforts to encourage new stewardship initiatives where they do not exist, and support on-going initiatives.

10.1.2 Outreach to landowners: a long term initiative

The promotion of Fraser Lake as a unique area, and introducing the concept of foreshore living as means by which to promote an ecologically sound way of living on the lake in a passive way (e.g., through general promotional material) may, or may not be successful in encouraging responsible lakeshore living. It will therefore be important to accompany any passive promotion with a door-to-door campaign. It is through this person-to-person contact that real change can be best accomplished. Initial steps in a door-to-door campaign should focus on the promotion of NWES as a locally-based society, while introducing the concept of lakeshore living. In other words, an initial door-to-door campaign would try to increase support of NWES and solicit information about how people use the lake, what changes they have seen and, what concerns they have about the lake, while at the same time introducing lakeshore stewardship.

An initial contact program could be a precursor to a follow-up visit that talks about the specifics of lakeshore living. At this time a variety of issues could be addressed including the proper functioning of septic and other waste disposal systems, the potential impacts of chemical inputs into lakes and streams (e.g., fertilizers, pesticides, and herbicides), the reduction of native vegetation around shorelines, and the impact of livestock on creeks and streams, both from a water quality perspective (e.g., the input of manure into streams) and from the potential effects of trampling of riparian areas (e.g., the increased siltation of streams that can be a result of livestock in riparian areas). It is likely that separate landowner contact programs will likely be needed for residential and agricultural audiences.

Landowner contact programs can be extremely effective in generating real, on-the-ground changes in land use; however, these programs rely on clear objectives, a well-crafted message, and a well-trained team of people to deliver the program. Difficulties in any of the above can cause landowner contact programs to falter. There are several good examples of these types of programs in BC. These organizations are listed in Appendix 2.

10.1.3 White Swan Park: a demonstration site

A key component of an outreach program could involve the construction of a demonstration site. Currently White Swan Park functions as a day use park with a beach area and playground. It presently

represents a severely altered foreshore area that, given the appropriate attention, could help focus the importance of foreshore management. With careful planning, this park could become a focal area for the promotion of the lake as an ecologically significant area. The planting of native vegetation, construction of interpretative trails and possibly viewing platforms, could help galvanize support for wise lakeshore management, while also creating a focal point for visitors to the areas.

10.1.4 Outreach programs to boaters: responsible boating

While disturbance from the boating community may or may not be a factor at Ellis Island, it is important that that the community be apprised of the unique nature of this small island and the colony of nesting birds that it supports. It is also important that boaters are included in the general message of minimizing their effects on water quality. This type of program can be tied to NWES' general promotion of Fraser Lake as being a unique area in which to live. A specific program on boating etiquette could be developed that links boating safety with responsible boating use. Steps should also be taken in conjunction with the current volunteer warden of the Ellis Island Ecological Reserve, BC Parks, and members of NWES with the goal of developing an arrangement regarding the resumption of the regular duties of the warden of this reserve.

10.1.5 Establishment of a dialogue with farms that support feeding waterfowl

One of the most critical factors involving the long-term persistence of Fraser Lake as a continentally important IBA for waterfowl is the bird's access to adjacent agricultural lands. Therefore, a dialogue with farmers whose fields are utilized by waterfowl should be established in order to make sure any concerns that they have related to waterfowl use of these areas are addressed. Any type of program related to the contact of farm owners should be done in conjunction with Ducks Unlimited Kamloops, as this DU office looks after on-going projects with landowners in the Fraser Lake area.

10.1.6 Establishment of an interpretive centre (CERC-Coordination, Education, and Resource Centre

An interpretative/resource centre that houses material pertaining to the Fraser Lake area is worthy of consideration. This type of centre could provide a centre point for lakeshore living as well as providing a destination for visitors coming to Fraser Lake. This centre could be built in conjunction with a potential demonstration site at White Swan Park. Of note is that an interpretive centre may reach visitors/tourists more than the residents of the area. If this is the case, then this expenditure of funds may not result in changes in land use and hence, may not benefit the lake as a whole.

10.2 Role as lobby/advisory group

NWES could play an important role in lobbying the federal, provincial, regional, and municipal governments in areas that could potentially affect the vision of the society. Areas where NWES may be interested in lobbying the various levels of government are presented in Table 5.

10.3 Integration/cooperation of NWES with other communities and non-government groups.

Since much of the nutrients entering Fraser Lake come upstream areas it will be important for NWES to establish a dialogue with as many upstream communities and non-government organizations as possible. Close cooperation with organizations operating upstream will greatly enhance the effectiveness on any similar program focusing on Fraser Lake proper.

10.4 Potential prerequisites for the successful implementation of above projects.

10.4.1 Historical land use survey

A historical land use study might be a beneficial tool that could help assist the actions of NWES by identifying changes that have occurred in the recent past. This project, which would parallel the sediment core study that was conducted by MWLAP and could help indicate where water quality related

problems in the lake may have originated, and would indicate how much and where land conversion has occurred.

Table 5. Potential areas where NWES could act in the capacity of a lobby/advisory group

Level of government	Specific Branch	Area of interest
Federal	Coast Guard	Status and enforcement of new regulations regarding boating. Lobby for new regulations if appropriate
Provincial	MWLAP (Smithers)	Water quality issues upstream of Fraser Lake
	MWLAP (Prince George)	Inquire about status of lakeshore survey, request survey to be done, if not already planned
	BC Assets and Land Corporation	The sale of lakeshore property in Fraser Lake drainage basin and the potential effects to the water of Fraser Lake
Regional	Planning	Status of lakeshore guidelines for the Regional District of Bulkey-Nechako. If none are in place, then request their development and provide input where possible.
Municipal	Water treatment	Provide input for water treatment by the Village
	Planning	Provide input for any changes proposed for White Swan Park

10.4.2 Land Use Surveys (local and landscape levels)

There are three land use surveys that could benefit work by NWES. These include 1) a lake shore survey, 2) an assessment of agricultural influences in the immediate area of the lake, and 3) a landscape level analysis of both forestry and agricultural influences in the Fraser Lake drainage area. In several of the lakes in the Prince George area, MAWLP has commissioned a photo survey of lakeshore practices that may impair water quality. These surveys are then used to illustrate the percentage of properties that represent potential problems to water quality by the type of land use activity (e.g., vegetation clearing, cabin encroachment, use of breakwaters, use of inappropriate materials for floatation devices in docks). An assessment of the influence of agricultural practices along the shores and upland areas in the Fraser Lake area would also be useful to help identify potential areas of concern within the immediate area of the lake. Finally, a landscape level analysis should be carried out that would include both agricultural and forestry related activities in order to identify regional areas of concern. Data from theses analysis would also be useful in the design and implementation of a landowner contact program(s).

10.4.3 Limnological Research

The analysis of the lake bottom core sample has determined that the water quality of Fraser Lake has not changed significantly in the recent past. However, this analysis does not identify present problems, if any, and where they may originate. As a result, an in-depth limnilogical assessment of water quality may be required.

10.5. Research and monitoring

10.5.1 Resurveys of migratory waterfowl and regular monitoring

Upwards of ten years have passed since the last aerial surveys of migratory waterfowl on Fraser Lake were conducted. Resurveys of this area are therefore merited. Furthermore, consideration should be given to the establishment of a regular monitoring program.

10.5.2 Moulting surveys

While it is known that Fraser Lake is a significant migratory stopover site, it is also believed that it is also significant moulting area. However, there is a general lack of data to establish which species are using the lake as a moulting area, and what habitat types these birds are selecting.

Table 6. Tentative 5-year plan for the Nad'leh Bun Watershed Enhancement Society

Activity ***Timeline***

Passive public awareness/ interpretative projects	Year 1	Year 2	Year 3	Year 4	Year 5
Building display that highlights Fraser Lake and NWES					
Production of Nad'leh Bun promotional material					
Continue local media publicity campaign					
Develop website					
Develop air photo mosaic showing Fraser L. past and present*					
Liaise with other stewardship organizations					
Liaise with other communities					
Construct interpretive centre					
Develop White Swan Park (or some other demonstration site)					
Develop and house lakeshore material in visitor centre					
Lobby efforts					

Land owner contact programs	Year 1	Year 2	Year 3	Year 4	Year 5
Contact Living by Water and arrange meeting with NWES					
Nad'leh Bun promotion & introduction to lakeshore living					
General shoreline issues*					
Discussions/workshops on septic systems					
Rural agricultural (outreach to landowners with waterfowl)*					
Rural agricultural (riparian management issues)					
Boaters					
Assessment of agricultural influences***					

* could be part of display

** this could include the following: Homesite Assessment, development of Shoreline Ambassador program, conducting local workshops (see www.livingbywater.ca)

*** this would have to be done in cooperation with Ducks Unlimited. It would be good to talk to individual landowners that have waterfowl feeding in their fields

11. Evaluating Success

The success of this conservation plan will depend, in part, upon the ability of NWES to fulfill their goals in becoming a vibrant, action-orientated enhancement society. This organization has already made large strides in accomplishing this goal. They have developed ties within the community and have forged partnerships with numerous organizations both within and outside of the immediate area. The future challenges of this society will be to garner further community support for the organizations and to carry out effective on–the-ground conservation activities. A key component to this will be to have a well-defined plan of action, with clearly defined, measurable targets and realistic timetables.

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13.1 Personal communications

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Appendix 1. Common and scientific names of mentioned in the text

Plants	
Canada waterweed	*Elodea canadensis*
Duck potato weed	*Sagittaria platphylla*
Sago pondweed.	*Potamogeton pectinatus*
clover	*Trifolium spp.*
cattails	*Typha latifolia*
bulrushes	*Scirpus spp.*
Coontail	*Ceratppyllum demersum*
Eurasian Water-milfoil	*Myriophyllum spicatum*
rose	*Rosa spp.*
Raspberry	*Rubus idaeus*
Fescue	*Festuca spp.*
Bluegrass	*Poa spp.*
Stonecrop	*Sedum spp.*
Fish	
Dolly Varden	*Salvelinus malma*
Lake Trout	*Salvelinus namaycush*
Mountain Whitefish	*Prosopium williamsoni*
Rainbow Trout	*Oncorhynchus mykiss*
White Sturgeon	*Acipenser transmontanus*
Burbot	*Lota lota*
Northern Pike-minnow	*Ptychocheilus oregonensis*
Largescale Sucker	*Catostomus macrocheilus*
Peamouth Chub	*Mylocheilus caurinus*
Birds	
Common Crow	*Corvus brachyrhynchos*
Tree Swallow	*Tachycineta bicolor*
Common Loon	*Gavia immer*
American Wigeon	*Anas americana*
Trumpeter Swan	*Cygnus buccinator*
Golden Eye	*Bucephala spp.*
Bufflehead	*Bucephala albeola*
Coot	*Fulica americana*
Redhead	*Aythya americana*
Herring Gull	*Larus argentatus*
Ring-billed Gull	*Larus delawarensis*

Appendix 2. BC stewardship programs

Stewardship/Conservation Orgainzations

BC Lake Stewardship Society	www.nalms.org/bclss/
BC Stewardship Centre	www.stewardshipcentre.org
Charlie Lake Conservation Society	www.myfortstjohn.com/clcs
Comox Valley Citizens' Action for Recycling and the Environment	care@mars.ark.com
Comox Valley Project Watershed Society	www.panorama-map.com/z-pointsite/mapimages/pwsite/index.html
Ducks Unlimited Canada	www.ducks.ca
Living by Water	www.livingbywater.ca
Pacific Stream Keepers Federation	www-heb.pac.dfo-mpo.gc.ca/PSkF/home.htm
The Land Stewardship Centre of Alberta	www.landcentre.ca
The Federation of BC Cottage Owners and Associations	www.bccottage.com
Turtle Island Earth Stewards	www.ties.bc.ca
The Land Conservancy of BC	www.conservancy.bc.ca

Appendix 3: IBA Canada Partners

Federation of BC Naturalists (FBCN)

"To know nature and to keep it worth knowing"

The Federation of BC Naturalists is a family of naturalist organizations dedicated to fostering an appreciation and understanding of our natural environment, so that it may be used wisely and maintained for future generations. We believe that negotiation and cooperation are ways to build a lasting conservation strategy in British Columbia. Through partnerships with other organizations and governments we strive to further conservation and natural history education in the province of BC. Our membership is open without prejudice to all who share our goals.

The FBCN was founded in 1969, although many of its member clubs have been in existence for much longer. There are currently 51 federated and affiliated member clubs and approximately 5,300 members from communities all around British Columbia. The FBCN is an affiliate of the Canadian Nature Federation. The FBCN is active in nature education and conservation, and is the British Columbia lead agency for two major projects: The Living by Water Project and the BC Important Bird Areas Program. The FBCN website is www.naturalists.bc.ca

WBT Wild Bird Trust of BC

Wild Bird Trust is non-profit society dedicated to the protection of birds and their habitats, on the principle that all wildlife must benefit. This mission is carried out through the establishment and management of wildlife sanctuaries, the production of various publications that address conservation and management concerns for birds and their habitats throughout the Province, the housing of the largest regional electronic database and reference library for birds, reptiles and amphibians in the Province, school- and home-based wildlife education programs, volunteer-based inventory programs and an active Heron stewardship program in the Georgia Basin of BC.

BirdLife International

A pioneer in its field, BirdLife International (BL) is the first non-government organization dedicated to promoting world-wide interest in and concern for the conservation of all birds and the special contribution they make to global biodiversity. BirdLife operates as a partnership of non-governmental conservation organizations, grouped together within geographic regions (e.g. Europe, Africa, Americas) for the purpose of planning and implementing regional programs. These organizations provide a link to on-the-ground conservation projects that involve local people with local expertise and knowledge. There are currently 20 countries involved in the Americas program throughout North, Central and South America.

For further information about BirdLife International, check the following web site: http://www.birdlife.net/.

The Canadian Important Bird Areas Program has been undertaken by a partnership of two lead agencies. The Canadian Nature Federation and Bird Studies Canada are the Canadian BirdLife International partners.

The Canadian Nature Federation (CNF)

The Canadian Nature Federation is a national conservation organization with a mission to be Canada's voice for the protection of nature, its diversity, and the processes that sustain it. The CNF represents the naturalist community and works closely with our provincial, territorial and local affiliated naturalists organizations to directly reach 100,000 Canadians. The strength of our grassroots naturalists' network allows us to work effectively and knowledgeably on national conservation issues that affect a diversity of ecosystems and human populations in Canada. The CNF also works in partnership with other environmental organizations, government and industry, wherever possible.

Our approach is open and cooperative while remaining firm in our goal of developing ecologically-sound solutions to conservation problems. CNF's web site is http://www.cnf.ca.

Bird Studies Canada (BSC)

The mission of Bird Studies Canada is to advance the understanding, appreciation and conservation of wild birds and their habitats, in Canada and elsewhere, through studies that engage the skills, enthusiasm and support of its members, volunteers, staff and the interested public. Bird Studies Canada believes that thousands of volunteers working together, with the guidance of a small group of professionals, can accomplish much more than could the two groups working independently. Current programs collectively involve over 10,000 volunteer participants from across Canada.

Bird Studies Canada is recognized nation-wide as a leading and respected not-for-profit conservation organization dedicated to the study and understanding of wild birds and their habitats. Bird Studies Canada's web site is www.bsc-eoc.org/.